Application Of: Robert Benson, Henry Pixley and Souheil Zraik

For: Electronic Device Enclosure With Rotationally Locked Body and Header

BACKGROUND OF THE INVENTION

[01] The present invention relates to enclosures for electronic devices, and more particularly to enclosures having one or more hollow, cylindrical body portions with a header on one or both ends used in cable television (CATV) applications.

[02] Coaxial cable devices such as RF filters mounted upon circuit boards are commonly housed in cylindrical enclosures having so-called body and header portions. When the device is installed in the field, the installer typically used a wrench to connect and tighten the adjoining connector, thereby applying a torque to the header. This torque is often great enough to cause rotation of the header relative to the body, resulting in failure of the device. Prior attempts to address this problem have included providing flat (i.e., linear) sides on the otherwise circular header which mate with flat sides on the interior of one end of an outer sleeve surrounding both the body and header. Such arrangements, although they may rotationally lock the header and outer sleeve, do not ensure that the header and body will not rotate relative to one another.

[03] Of course, it is necessary that the body and header of such devices be permanently assembled in a manner which prevents longitudinal separation of the parts. This feature is commonly provided in current designs by an inductive soldering operation having a number of drawbacks not the least of which is the requirement to purchase and maintain the inductive soldering equipment. This equipment is added to multiple pieces of

automated assembly equipment to control all aspects of the soldering process which is extremely critical to function or failure of the device. The many uncontrollable variables make the soldering process very unstable, resulting in high maintenance cost as well as higher scrap rates. Some of these variables are induction coil diameter, coil spacing between the wrapped coils, power connection channels, temperature of product/process areas and cooling system efficiency. Furthermore, spare parts must be stocked for the soldering equipment, creating an additional expense, as does the power required to operate the equipment. Consequently, significant savings could be realized by elimination of the induction soldering operation.

[04] The principal object of the present invention is to provide an electronic device for the CATV industry having novel and improved means for maintaining a cylindrical body in assembled relation with a header.

[05] Another object is to provide an electronic device including a housing formed by a hollow cylindrical body with a header at one or both ends wherein torque may be applied to the device without relative rotation of the body and header.

[06] A further object is to provide means for preventing relative rotation of header and body portions of an electronic device in response to torque applied to the device during installation in the field.

[07] It is also an object of the invention to provide means for longitudinal locking of body and header portions of an electronic device without requiring any soldering operation.

[08] Still another object is to provide a method of constructing and assembling hollow enclosures for coaxial cable devices which include a cylindrical body closed at one or

both ends by a header wherein toque applied to the header does not result in relative rotation of the body and header.

[09] Other objects will in part be obvious and will in part appear hereinafter.

SUMMARY OF THE INVENTION

[10] In furtherance of the preceding objects, the invention contemplates an enclosure including a hollow, cylindrical body with one or more notches formed in (i.e., cut out of) the cylindrical wall at the end(s) to which a header is applied to provide an end closure. The header is provided with integral tabs extending axially from the periphery to mate with the notches in the body. Thus, when the header is placed on the end of the body, the tabs extend into the notches and effectively prevent relative rotation of the two parts. In a first embodiment, consisting of a single body with male and female headers at opposite ends, the headers and body are assembled with a slip fit and are thereafter enclosed and restrained from relative axial movement by a tightly fitting, outer sleeve which is formed over each end of the device. In the second disclosed embodiment, a 6-pole device having three body portions, a shield and a cap, in addition to a header at each end, longitudinally adjoining parts are assembled with an interference fit, being thereby maintained in longitudinally assembled relation.

[11] Details of construction and operation of the invention will be more clearly understood and fully appreciated from the following detailed disclosure, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[12] Figure 1 is an exploded perspective view showing elements of a first embodiment of the invention:

[13] Figure 2 is a front elevational view of the elements of Figure 1 in assembled relation, with portions broken away;

[14] Figure 3 is an elevational view of the device of Figures 1 and 2 in full section following assembly with an additional element;

[15] Figure 4 is an exploded perspective view showing elements of a second embodiment of the invention;

[16] Figure 5 is a front elevational view of the elements of Figure 4 in assembled relation, with portions broken away;

[17] Figure 6 is a plan view in section on the line 6-6 of Figure 5; and

[18] Figure 7 is an elevational view of the device of Figures 4 and 5 in full section following assembly with an additional element.

DETAILED DESCRIPTION

[19] Referring now to the drawings, in Figures 1-3 is shown a first embodiment of elements of an enclosure for an electronic device such as an RF trap for use in CATV applications. The elements shown in Figures 1 and 2 consist of a hollow, cylindrical body 10 having opposite ends 12 and 14 in parallel planes, male header 16 and female header 18. Notch 20 and a corresponding notch on the diametrically opposite side (not seen in Figure 1) are cut into the wall of body 10 on opposite sides of end 12, and notches 22 and 24 are cut into the body wall on opposite sides of end 14.

[20] Male header 16 includes central, annular portion 26 having a diameter substantially equal to the outer diameter of body 10, and annular portion28 having a diameter substantially equal to the inner diameter of body 10. Stem portion 30 extends from one side of male header 16 and diametrically opposed tabs 32 and 34 extend from

the other side, i.e., the said facing body 10. Tab 32 includes central portion 36, outer portion 38 and inner portion 40; likewise, tab 34 includes central, outer and inner portions 42, 44 and 46, respectively. A central opening, having internal threads 48, extends through male header 16.

[21] Female header 18 includes annular portions 50 and 52, having diameters substantially equal to the outer and inner diameters, respectively, of body 10. Stem portion 54, having external threads 56, extends from one side of the header and a pair of diametrically opposite tabs, one of which is seen in Figure 1 and denoted by reference numeral 58, extend from the other side. Tab 58 includes central, outer and inner portions 60, 62 and 64, respectively, i. e., the four tabs extending from the two headers are substantially identical. Central opening 66 extends through header 18.

[22] The body and headers are shown in assembled relation in Figures 2 and 3. Tabs 32 and 34 of header 16 have been placed in slot 20 and the corresponding slot on the opposite side of end 12 of the body, respectively. Likewise, tab 58 and the corresponding tab on the diametrically opposite side of header 18, indicated in Figure 2 by reference number 68, have been placed in slots 22 and 24, respectively. The diameter at the outer surfaces of outer tab portions 38 and 44 is substantially equal to the diameter of annular portion 26, i.e., to the outer diameter of body 10. The diameter at the outer faces of central tab portions 36 and 42 is substantially equal to the diameter of annular portion 28 and the inner diameter of the body. Thus, when the elements are placed in axially adjoining relation, the outer portion of each tab (e.g., portion 44) extends into and abuts the inner side of the corresponding notch, and the central portion of each tab (e.g., portion 42) extends into the body adjacent the inner wall of body 10. The circumferential

extent (width) of each tab is about the same or slightly less than that of the notches, whereby the elements are rotationally locked when placed in axially adjoining relation. That is, the outer portions of the tabs extend through the corresponding notches and, having widths approximately equal to those of the notches, effectively prevent relative rotation of the body and headers as torque is applied to one of the elements by a wrench. Assembly is completed by axial insertion of the body and headers into a closely fitting sleeve 70 and forming opposite ends 72 and 74 of the sleeve over the outer peripheries of headers 16 and 18, respectively, thereby retaining the body and headers in axially assembled relation.. Hole 76 is provided in a side wall of body 10 for insertion of a tool by an assembler to tweak and tune the circuit components (not shown) within the body to final specifications.

[23] Turning now to Figures 4-7, the invention is shown in a second embodiment. This is a six-pole device including male and female headers 78 and 80, which are identical to headers 16 and 18, respectively, of the previous embodiment. However, instead of one body member, open and notched at both ends, the present embodiment includes three body portions, termed first, second and third body portions and numbered 82, 84 and 86, respectively. First body portion 82 includes notches 88 and 90 extending into the body wall from end 92. Notch 94, and a diametrically opposite slot not seen in Figure 4, extends into open end 96 of second body portion 84, the other end being closed by wall 98, having openings 100. Third body portion 86 includes notch 102, and a corresponding notch on the opposite side, extending into open end 104; wall 106, having openings 108, closes the other end of body portion 86. Opening 108 is used not only for inserting a tuning tool, but also for inserting potting (conformal) material which fixes the

tuned components permanently in place. The end of first body portion 82 opposite end 92, not seen in Figure 4, is also closed by a wall having openings corresponding to openings 100 and 108.

[24] Locking shield 110 is interposed between first and second body portions 82 and 84, respectively, and includes protrusions 112 on one side for engagement in holes in the closed end of body portion 82 and corresponding protrusions (not shown) on the opposite side for engagement in the outer two of holes 100 in end wall 98 of second body portion 84. Locking ring 114, having end wall 116 with opening 118, is interposed between second and third body portions 84 and 86. Tabs 120 and 122 extend into slot 94 and the corresponding slot on the other side of end 94 of body portion 84 and protrusions (not shown) on the underside of wall 116 extend into the outer two of holes 108. Tab 124 on header 80 extends into notch 88 and the corresponding tab on the opposite side of header 80 extends into notch 990. Tabs 126 and 128 of header 78 extend into notch 102 and the corresponding notch on the opposite side of end 104 of third body portion 82. In the present embodiment, it is preferred that the tabs on the headers and locking ring engage the body portions with an interference fit. Openings 136 are provided in header 80 for engagement by a spanner wrench to tighten the device to an adjoining connector.